

Weekly Report

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Projects

0.1 A New Idea on DeepVis

This week I discussed with Fangzhou and Dongming on how to design graph layout algorithms with deep learning methods. The core idea is to use (deep) reinforcement learning methods to simulate each iteration step in the traditional force-directed graph layout algorithm. We thought that as the force-directed layout is based on a physical model, a machine learning model can be used to mimic the related behavior and optimization processes. Our idea includes three layers of explorations:

1. Use (deep) reinforcement learning methods to simulate the original force-directed process. In each optimization iteration, a graph node can be moved to a direction. The ML model is used to decide the direction (here we consider the directions as discrete ones). The moving distance is constant.
2. If the process is learnable, we will try a new two-stage approach based on deep reinforcement learning and AlphaGo:
 - **A strategy network:** for each iteration, only a set of graph nodes are to be moved but not all nodes. The strategy network is used to choose these nodes.
 - A value network (or module): this part is intended to generate the moving directions of the graph nodes selected by the strategy network. Note that the moving distance is also an important value however I haven't figure out how to put this part into the approach, thus just set it as a constant value.

Our hope is that: By utilizing the (deep) reinforcement learning model, the essence of traditional force-directed layout processes can be learned. Furthermore, it is more important if the model is able to “create” its own optimization path from the learned knowledge, thus reduce the number of iterations. The strategy network can be used to further reduce the computational cost in each iteration by judging nodes which are not necessary to be moved.

As the first step, we prepare to use traditional “shallow” reinforcement learning methods such as Q-learning to try the simulation part. Dongming has started to use Python PyBrain to do some experiments.

Plan for the Next Week

- InfoVis paper review;
- Book;
- Slides for the summer school.